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I observed several times in February and March, 1858, the interesting Nebula found by Hind in 1852, and observed by D'Arrest and Breen in 1855 and 1856, and finally missed by D'Arrest in October 1861. In 1858 I found it to be fainter than it ought to have been, according to the description of D'Arrest in 1855. At that time I saw it with a telescope of 4⅓ inches aperture, but, in January and September 1861, I could not find it with the 6-inch heliometer, nor have I been able to find it after repeated searches during the last five months. The variability of the accompanying star I remarked in November 1861, as I found it to be of the 11–12 magnitude, while in 1858 it was of the 10th magnitude. At present it appears to be getting somewhat brighter, and is of the 11th magnitude.

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## *Extract of a Letter from Mr. A. Auwers to the Rev. R. Main, dated Königsberg, 1862, March 21, on the Orbit of Procyon, and on the Positions of the Radcliffe Catalogue.*

(*Communicated by the Rev. R. Main.*)

I am much obliged for your answer to my letter of the 21st of February. Learning from your letter that the results of my researches on variable Proper Motions may perhaps be interesting to you, I add to the formula for correcting the tabular Declinations of *Sirius*, given in my preceding letter, also the elements of the orbit of *Procyon*, derived from all available observations of Right Ascension and Declination, made between 1750 and 1860:—

| | | | | | |
|---|---|---|---|---|---|
| Epoch of minimum in R.A. | $=\mathrm{T}$ | $1795{\cdot}5676$ | Probable error | | $\pm 0^{\mathrm{y}}{\cdot}4457$ |
| Time of revolution | $=\mathrm{U}$ | $39^{\mathrm{y}}{\cdot}972$ | ,, | ,, | $\pm 0^{\mathrm{y}}{\cdot}4043$ |
| Mean yearly motion | $=n$ | $9^{\circ}{\cdot}00634$ | ,, | ,, | $\pm 0^{\circ}{\cdot}09110$ |
| Radius of circle | $=r$ | $1''{\cdot}0525$ | ,, | ,, | $\pm 0''{\cdot}0275$ |

There is not the least trace of ellipticity indicated by the observations. The corrections to be applied to the Right Ascension of Wolfers' *Tabulæ Reductionum*, relative to the mean of the stars *Aldebaran*, *Rigel*, *α Orionis*, *Pollux*, *α Hydræ*, and *Regulus*, and to the Declination of the same tables, relative to *α Ceti*, *α Orionis*, *α Serpentis*, *γ*, *α*, *β Aquilæ*, and *α Aquarii*, are the following:—

$$d\alpha = +0\overset{\mathrm{s}}{\cdot}0033 \quad -0\overset{\mathrm{s}}{\cdot}001192 \; (t-1830) \quad -0\overset{\mathrm{s}}{\cdot}0705 \cos n\,(t-\mathrm{T}),$$

$$d\delta = +0\overset{''}{\cdot}201 \quad +0\overset{''}{\cdot}00931 \; (t-1830) \quad +1\overset{''}{\cdot}853 \sin n\,(t-\mathrm{T}).$$

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The mass of the dark companion of *Procyon* is probably not less than three-quarters of the mass of the Sun.

Variations have also been supposed to take place in the proper motions of *α Virginis*, *α Hydræ*, and *β Orionis;* but in all these cases the results of my researches are entirely negative, showing with evidence that there exist no variations in the motions of these stars.

The reason of my again taking the liberty to write to you is a paper "On the Positions of the Radcliffe Catalogue," in No. 9 of vol. xxi. of the *Monthly Notices*. It has not been before now that I have learnt that Mr. Safford calls attention by this paper to a rather large discrepancy between a formula, given by me in No. 1300 of the *Astronomische Nachrichten*, for correcting the Declinations contained in the vol. i.–xiv. of the *Radcliffe Observations*, so as to make them agree with Wolfers' *Tabulæ Reductionum*, and the corrections to be applied to these Declinations according to the late Mr. Johnson's investigation in vol. xv.

The formula has been derived, as it is stated in the *Astronomische Nachrichten*, from Mädler's comparisons (*Dorpat Observations*, xiv.), and represents them very accurately between the Declinations 40° and 80°. But now the definitive Declinations of the Radcliffe Catalogue having been substituted to the provisionally adopted ones of the *Observations*, I have thought it advisable to undertake a direct comparison of the first with some other Catalogues, the relations of which to the *Tabulæ Reductionum* are accurately known.

There occur 231 stars of the Radcliffe Catalogue in Argelander's Abo Catalogue reduced to 1845, and corrected for the difference between the constants of Nutation adopted in the construction of the Catalogue and the computation of the Proper Motions and the true value $=9''\cdot223$; the correction to be applied to the Declinations being $+0''\cdot244 \sin(\text{R.A.} - 0^{h}36^{m})$, and to the Proper Motions $0''\cdot0081 \sin(\text{R.A.} + 0^{h}55^{m})$. Argelander's Declinations differ from Johnson's (corrected, where necessary, according to the introduction of the Catalogue) by the following quantities, A—R, to which I have also added the differences W—A between the *Tabulæ Reductionum* and the Abo Catalogue, reduced to the year 1845, and the differences W—R, resulting from the addition of the numbers A—R and W—A.*

| Decl. | A—R. | Stars Comp. | W—A. | W—R. |
|---|---|---|---|---|
| ° | ″ ″ | | ″ | ″ |
| −16·6 | +1·45 ±0·15 | 17 | −0·72 | +0·73 |
| − 4·9 | +1·10 ±0·19 | 11 | −0·63 | +0·47 |
| + 4·9 | +0·35 ±0·13 | 24 | −0·53 | −0·18 |
| +14·9 | +0·73 ±0·18 | 12 | −0·41 | +0·32 |

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* Four stars presenting large differences have been excluded in taking the means.

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| Decl. | A − R. | Stars Comp. | W − A. | W − R. |
|---|---|---|---|---|
| ° | ″ ″ | | ″ | ″ |
| +25·9 | −0·41 ±0·21 | 9 | −0·25 | −0·66 |
| +35·9 | −0·50 ±0·24 | 7 | −0·09 | −0·59 |
| +41·7 | −0·12 ±0·10 | 38 | −0·01 | −0·13 |
| +48·8 | +0·12 ±0·11 | 31 | +0·10 | +0·22 |
| +53·3 | +0·53 ±0·12 | 27 | +0·18 | +0·71 |
| +62·5 | +0·45 ±0·14 | 19 | +0·26 | +0·71 |
| +69·8 | +0·67 ±0·15 | 17 | +0·27 | +0·94 |
| +76·7 | +0·92 ±0·22 | 8 | +0·24 | +1·16 |
| +84·1 | +0·99 ±0·22 | 7 | +0·15 | +1·14 |

In a similar way I have found by 408 stars common to the Radcliffe Catalogue and Struve's *Positiones Mediæ* (including 93 already made use of in the preceding investigation),

| Decl. | S − R. | Stars Comp. | W − S. | W − R. |
|---|---|---|---|---|
| ° | ″ ″ | | ″ | ″ |
| −15·4 | +1·81 ±0·24 | 10 | −0·82 | +0·99 |
| + 2·0 | +0·79 ±0·16 | 19 | −0·83 | −0·04 |
| +16·2 | +0·52 ±0·17 | 20 | −0·39 | +0·13 |
| +30·6 | −0·49 ±0·18 | 18 | −0·23 | −0·72 |
| +41·1 | +0·08 ±0·09 | 70 | −0·25 | −0·17 |
| +48·6 | +0·29 ±0·10 | 53 | −0·21 | +0·08 |
| +55·1 | +0·51 ±0·08 | 80 | −0·09 | +0·42 |
| +62·4 | +0·48 ±0·10 | 56 | +0·11 | +0·59 |
| +69·3 | +0·77 ±0·12 | 37 | +0·18 | +0·95 |
| +76·6 | +0·53 ±0·15 | 25 | +0·14 | +0·67 |
| +83·7 | +0·89 ±0·17 | 20 | +0·02 | +0·91 |

The mean of the two nearly agreeing systems of values W−R becomes, for the circumpolar stars,

| Decl. | W − R. | Stars. | Formula. | C − O. |
|---|---|---|---|---|
| ° | ″ | | ″ | ″ |
| 41·4 | −0·15 | 108 | −0·16 | −0·01 |
| 48·7 | +0·13 | 84 | +0·16 | +0·03 |
| 55·2 | +0·49 | 107 | +0·41 | −0·08 |
| 62·4 | +0·62 | 75 | +0·16 | +0·04 |
| 69·5 | +0·95 | 54 | +0·84 | −0·11 |
| 76·6 | +0·79 | 33 | +0·95 | +0·16 |
| 83·8 | +0·97 | 27 | +1·02 | +0·05 |

Assuming the Weights of these numbers nearly proportional to the numbers of the stars compared, I have derived from them the following formula:—

$$W - R = -2''\!\cdot\!53 + 3''\!\cdot\!59 \sin\delta.$$

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The column headed C—O contains the small remaining differences between this formula and the observed values. Tabulating the values of the formula with changed sign, we receive the following

Corrections of the N.P.D. of the Radcliffe Catalogue.

| N.P.D. | | Observ. vol. i.–xiv. Johnson. | Formula. |
|---|---|---|---|
| ° | ″ | ″ | ″ |
| 0 | −1·06 | +0·92 | −0·14 |
| 5 | −1·05 | +0·97 | −0·08 |
| 10 | −1·01 | +1·03 | +0·02 |
| 15 | −0·94 | +1·10 | +0·16 |
| 20 | −0·84 | +1·15 | +0·33 |
| 25 | −0·72 | +1·23 | +0·51 |
| 30 | −0·58 | +1·28 | +0·70 |
| 35 | −0·41 | +1·34 | +0·93 |
| 40 | −0·22 | +1·38 | +1·16 |
| 45 | −0·01 | +1·43 | +1·42 |
| 50 | +0·22 | +1·46 | +1·68 |

In the vicinity of the pole, therefore, the provisionally adopted Declinations of the *Observations* agree far better with the *Tabulæ Reductionum* than the corrected Declinations of the Catalogue; but in Polar Distances greater than 25°, the opposite takes place.

The differences given by the Southern stars are somewhat irregular and less sure; the number of these occurring in the Catalogue being not at all great, I have thought it sufficient to join the values found between 54° and 106° N.P.D. to the circumpolar formula by drawing a simple curve, from which I have taken the following corrections of the N.P.D. of the Catalogue:—

| N.P.D. | | N.P.D. | |
|---|---|---|---|
| ° | ″ | ° | ″ |
| 55 | +0·5 | 85 | −0·1 |
| 60 | +0·6 | 90 | −0·3 |
| 65 | +0·6 | 95 | −0·5 |
| 70 | +0·5 | 100 | −0·7 |
| 75 | +0·3 | 105 | −0·8 |
| 80 | +0·1 | 110 | −1·0 |

I may also mention that the differences between the Radcliffe Declinations and Argelander's in the hours 3—11 of R.A. are on the whole smaller (about 0″·5) than in the other hours; but in the comparisons with Struve, no such variation being shown, I have not had regard to it. The probable error of a difference A—R, by one star, is found from the circumpolar

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stars to be ±0″·622, and that of a difference S−R is found to be ±0″·743. The probable error of a Declination of the Abo Catalogue being ±0″·27 and that of the reduction to 1845 being ±0″·16, the probable error of a Declination of the Radcliffe Catalogue becomes, from the comparisons with Argelander, ±0″·54.

*Observatory, Königsberg, March 21, 1862.*

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## *Observations of Transit of Mercury, Solar Eclipse, and Occultation of Venus.* By M. C. Bulard, Director of the Observatory of Algiers.

(*Communicated by the Astronomer Royal.*)

### *Transit of Mercury,* 1861, *November* 11, *observed at the Observatory of Algiers.*

Egress, exterior* contact.

|  | h | m | s |  |
|---|---|---|---|---|
|  | 21 | 31 | 50·673 | Algiers Mean Time, |
| or | 21 | 28 | 28·073 | Paris Mean Time. |

### *Solar Eclipse of* 1861, *December* 31.

The disturbed state of the country prevented M. Bulard from reaching the line of totality. The following observations were made at Ouargla:—

Latitude 31° 57′ 9″·0 N.; Longitude (approximate) 21$^{m}$ 5$^{s}$·33 E. of Greenwich.

|  | h | m | s |  |
|---|---|---|---|---|
| First Contact at | 2 | 18 | 3·8 | Ouargla Mean Time. |
| Last Contact at | 4 | 41 | 16·1 | ,, ,, |

### *Occultation of Venus by the Moon,* 1862, *February* 1, *observed at Laghouat.*

Latitude 33° 48′ 10″ N.; Longitude (approximate) 11$^{m}$ 33$^{s}$ E. of Greenwich.

|  | h | m | s |  |
|---|---|---|---|---|
| First Contact at ... ... ... | 6 | 55 | 10·558 | (Appl$^{y}$. Laghouat M. T.). |
| Disappearance of Left Horn of Venus | 6 | 55 | 58·515 | ,, |
| Disappearance of Right Horn ... | 6 | 56 | 0·011 | ,, |

(as seen in an inverting telescope).

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* There are the words of M. Bulard; but his diagram shows that it was internal contact. G. B. A.